another by a loose mass of fibres running parallel to the surfaces of the capsules.

In the middle body this middle layer of fibres is gathered into a bundle at the anterior margin of the body and passes out towards the central portion of the brain. Almost immediately the bundle divides. One division goes to the calices of the mushroom bodies, forming thus the antero-superior optic tract; the other to the lower posterior portion of the brain, forming the antero-posterior optic tract.

From the middle loose layer of fibres of the inner body several bundles arise, all penetrating the hinder portion of the brain. One bundle forms an upper, another a lower commissure between the two optic lobes.

The fibrillar elements from the retina terminate in five branches and thus help to form the outer mass of fibrillar substance. From cell bodies between the basement membrane of the retina and this mass fibres pass inward, give off short, fine fibrils connecting with the terminating fibrils just noted, and then go further inward, forming, with their fellows, the outer chiasma and terminate in a bunch of fibrils in the outer capsule of the middle body. These form neural elements 1. From cell bodies between the outer chiasma and the middle body fibres penetrate the outer capsule of the latter, giving off a bunch of lateral fibrils connecting with the terminals of elements No. 1. The main fibre then crosses the body to the inner capsule, gives off in it a group of short fibrils, then leaves the body, and after forming, with their fellows, the inner chiasma, finally terminate in the outer capsule of the inner body of the lobe.

From cell bodies between the margins of the two bodies neural elements No. 3 arise, that bear the same relations to the inner body and its capsules as do elements No. 2 to the middle body. Passing out of the concave surface of the inner body some of the elements are gathered into a bundle that passes forward, forming the anterior optic tract and terminate in the optic body, a small oval mass of fibrillar substance above the antennal lobe. Others go upward as a bundle of fibres to the calices of the mushroom bodies, forming thus the postero-superior optic tract.

The branching terminals of the fibres forming the antero-superior optic tract seem to connect with the lateral fibrils of element No. 2 in the inner capsule of the middle body, and the terminals of the fibres forming the posterior optic tracts connect similarly with the inner lateral fibrils of elements No. 3.

A stimulus to a retinal element may reach the central portion of the brain by passing over three or four neural elements and may reach either the mushroom bodies, the optic body or several portions of the posterior part of the brain, or passing over more elements it may reach all these regions, and even be transferred over the two optic commissures to the opposite lobe, and thus indirectly reach the mushroom bodies, the optic body or the posterior portion of the brain on the other side.

The earliest differentiation in the central nervous system of Vertebrates. A. SCHAPER.

The speaker presented briefly some of the results of his recent investigations on the histogenesis of the central nervous system which are to be published in extenso in the 'Archiv für Entwicklungsmechanik.' The essential points of this paper were the following:

1. The so-called '*Keimzellen*' of *His*, lying near the central cavity of the neural tube, along the membrana limitans interna, are not at all to be considered as a special type of cells in contrast to the main epithelial part of the medullary wall. They are nothing else than *epithelial cells in process of continuous proliferation* and serve in the earliest stage of develop-

ment only to increase the number of the epithelial components or their products of metamorphosis, the ependymal cells. By the continuous proliferating activity of the '*Keimzellen*' a considerable number of ependymal cells (at least in the case of higher Vertebrates) are gradually created. Thus a definite framework is brought into existence, in the meshes of which further processes of cellular development take place on prescribed lines. About this time the most important differentations in the neural tube begin. The descendants of the '*Keimzellen*' ceasing gradually to turn into ependymal cells are transformed into the mother cells of future nerve cells which, provided with certain histological characteristics, are expressively named '*neuroblasts.*' In the highest Vertebrates, moreover, the offspring of the '*Keimzellen*' appear, provided with still *higher capacity of differentiation*, in so far as they produce a generation of '*indifferent cells,*' which later on differentiate into either *nerve* or *neuroglia cells.*

2. The *ependymal cells*, as a whole, are to be considered as a *phylogenetically older* or an *embryonic stage* of supporting tissue which, in the ascending series of the Vertebrates or in the progress of ontogenetical development, loses gradually its morphological and physiological importance, and is at last replaced by a *cœnogenetic* form of supporting tissue, the *neuroglia* proper, the elements of which originate, like the nerve cells, from 'indifferent cells.'

3. The '*indifferent cells*' have the property of *locomotion* (especially developed in those of the cerebellum, where they give rise to the formation of the superficial granular layer of *Obersteiner*), a characteristic of the formative elements of the nervous system which is of great importance for a higher structural complication of the latter.

4. The so-called '*Mantelschicht*' of *His* is in the higher Vertebrates composed of 'indifferent cells' (not only of neuroblasts as *His* supposes), which later on differentiate into either *neuroblasts* or *spongioblasts* (the latter being the mother cells of neuroglia cells).

5. Not all *indifferent cells* undergo simultaneously such an early process of differentiation. A certain number remain for a longer or shorter time in an indifferent condition possessing moreover the property of *further propagation*, which activity is clearly shown by the appearance of karyokinetic figures within the 'Mantelschicht' during a certain period of development. This further proliferation of the structural elements of the neural tube is obviously adapted to furnish the material for the later development and completion of the intricate structure of the nervous system as it is found especially in the higher Vertebrates.

6. It is not improbable that these *indifferent cells* may play an important rôle in *regenerative processes* within the central nervous system even in postembryonic periods.

1. *Cranial Nerves of Bdellostoma dombeyi.* (Read by title.)

2. *The Structure of the Organ of Corti in Adult Man.* (Read by title.) H. AYERS.

The Visual Centers of Arthropods and Vertebrates. W. PATTON.

It is assumed, based on evidence advanced elsewhere, that the median ocellus of *Limulus* and the Arachnids is homologous with the pineal eye of Vertebrates, and that the lateral eyes of *Limulus* and the Merostomata are homologous with the lateral eyes of Vertebrates. In the Arachnids (*Limulus*), and probably in Vertebrates, the distal end of the median eye stalk contains one or more pairs of medianly fused ocelli. (1) From the proximal end of the eye stalk the median eye nerves separate, and encircling the posterior part of the fore-brain, just in front of the posterior commissure, terminate in *Limulus*, on the hæmal side of the fore-brain, in two great lobes which in